BOTANY.—*New species of* Erythroxylon *from Colombia.* WALTER A. GENTNER.[1] (Communicated by Lyman B. Smith.)

Four new species were determined while preparing a field guide to the genus *Erythroxylon* in Colombia. The guide in its entirety was submitted to the faculty of the Columbian College of the George Washington University in partial satisfaction of the requirements for the degree of master of arts. Plans for the publication of this guide have been delayed, and it seems well to record the new species here.

Measurements in the descriptions are all from dry material to keep the relative proportions of all parts. In the illustrations the details are from boiled material, but they are not appreciably larger except in the case of the stipules.

Erythroxylon cuatrecasasii Gentner, sp. nov.

Arbor 8 m alta; cortice obscure purpureo-brunneo, verruculoso, lenticellis dilute rubris; petiolo 3–6.5 mm longo, foliis lanceolatis, basi acutis, apiee acuminatis, 79–148 mm longis, 21–44 mm latis, bilineatis; stipulis non persistentibus, 1.5–2 mm longis, triangulatis, asetulosis; floribus uno vel plurimis in axillis foliorum vel ramentorum; pedicellis 4–9 mm longis, ad apicem versus incrassatis, 5-angulatis; ealyce ad ¾ partito, laminis 1–2 mm longis, late lanceolatis. Floribus brachystylis: calyce superante urceolum stamineum, orificio subintegro, staminibus 1.5 mm longis, stylis liberis, 1 mm longis, stigmatibus depresso-capitatis. Floribus dolichostylis: non visis. Drupa 8.5–10.5 mm longa, 3.5–4 mm diametro.

VALLE DEL CAUCA: Río Yurumangui, alt. 5–50 m, February 19, 1944. J. Cuatrecasas 15736.

This species differs from *E. gracilipes* and *E. acutum* in having lanceolate leaves.

Erythroxylon acutum Gentner, sp. nov.

Frutex vel arbor 3–4 m alta; cortice obscure purpureo-brunneo, verruculoso, lenticellis minutis dilute rubris; petiolo 3–7 mm longo, foliis oblongo-ellipticis, basi rotundatis, apice acuminatis, 30–81 mm longis, 14–32 mm latis, bilineatis; stipulis persistentibus, 1–1.5 mm longis, fimbratis, triangulatis, 3-setulosis; floribus uno vel plurimis in axillis foliorum vel ramentorum; pedicellis 4–6 mm longis, ad apicem versus incrassatis, 5-angulatis; calyce ad ½ partito, laciniis 1–1.5 mm longis, triangulatis, acutis; floribus dolichostylis non visis. Floribus brachystylis: urceolo stamineo calycem subaequante, orificio subintegro; staminibus 2.5–3 mm longis; stylis liberis, 2 mm longis; stigmatibus depresso-capitatis; floribus brachystylis e fragmentis solum cognitis. Drupa 7.5–9 mm longa, 2.5–3 mm diametro.

NARINO: Gorgonilla Island, alt. 130–200 m, February 28, 1939, E.P. Killip and H. García-Barriga 33082.

This species differs from *E. cuatrecasasii* in having oblong-elliptic leaves.

Erythroyxlon acrobeles Gentner, sp. nov

Frutex parvus, cortice griseo-brunneo, verruculoso; petiolo 3–5 mm longo, foliis obovatis vel ellipticis, basi acutis vel rotundatis, apice acutis, cuspidatis, mucronatis, 72–173 mm longis, 26–60 mm latis; stipulis 3.5–5 mm longis triangulatis, apice acutis, 2-setulosis; floribus uno vel plurimis in axillis foliorum vel ramentorum; pedicellis 4–9 mm longis, ad apicem versus incrassatis, 5-angulatis; calyce ad ½ partito, laminis 1–1.5 mm longis, ovatis, mucronatis. Floribus brachystylis: non visis. Floribus dolichostylis: staminibus inaequalibus, episepalis 0.4 mm longis, epipetalis 1.5–1.75 mm longis, urceolo stamineo calycem superante, orificio subintegro, stylis liberis, 0.75 mm longis, stigmatibus depresso-capitatis, ovario obovoideo. Drupa 13 mm longa, 7 mm diametro.

VALLE DEL CAUCA: Pacific coast at Río Cajambre, May 5–15, 1944, J. Cuatrecasas 17581.

This species differs from *E. cumanense* and *E. havanense* in having cuspidate leaves 72–173 mm long.

Erythroxylon haughtii Gentner, sp. nov.

Frutex ultra 2 m alta; cortice griseo-brunneo, verruculoso, lenticellis dilute rubris, ramulis recurvatis, compressis; petiolo 3–6 mm longo, foliis ovatis vel ellipticis, basi apiceque rotundatis, 22–57 mm longis, 23–32 mm latis; stipulis persistentibus, 1.5–2 mm longis, fimbriatis, triangulatis, 3-setulosis; floribus 1–4 in axillis foliorum vel ramentorum; pedicellis 7–11 mm longis, graciliter obconicis, 5-angulatis; calyce ad ¾

[1] Field Crops Research Branch, ARS, USDA, Beltsville, Md.

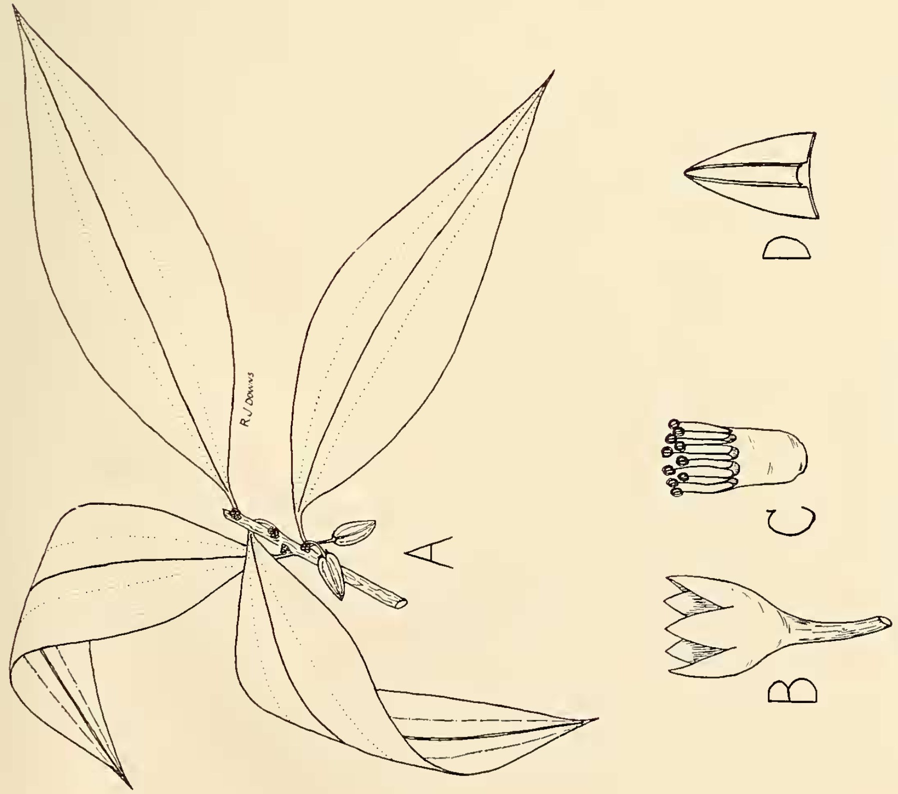

FIG. 1.—*Erythroxylon cuatrecasasii:* A, Habit, × ½; B, calyx, × 5; C, stamens, × 5; D, stipule, × 5.

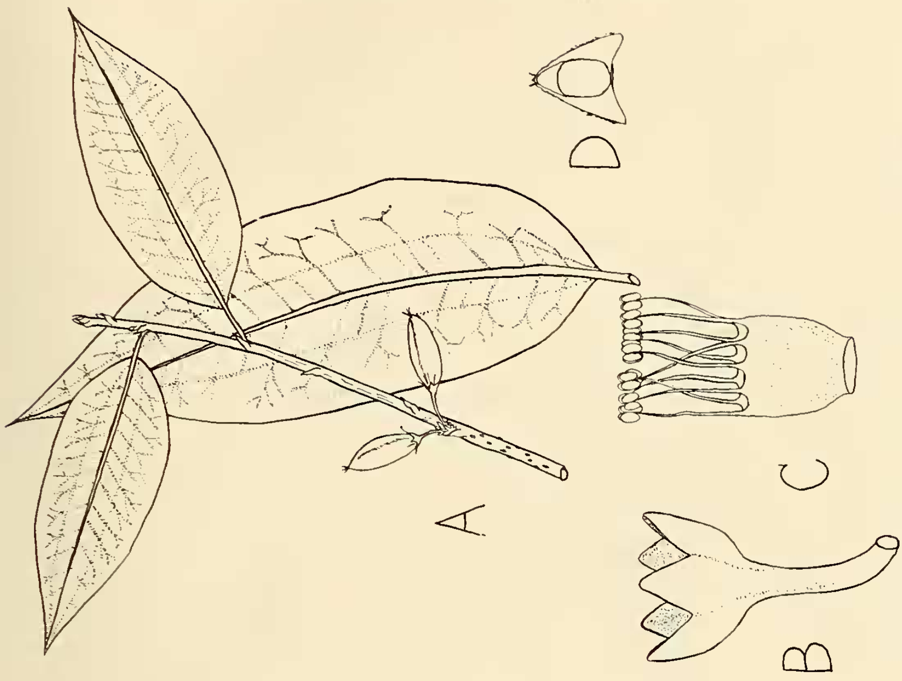

FIG. 2.—*Erythroxylon acutum:* A, Habit, × 1; B, calyx, × 5; C, stamens, × 5; D, stipule, × 5.

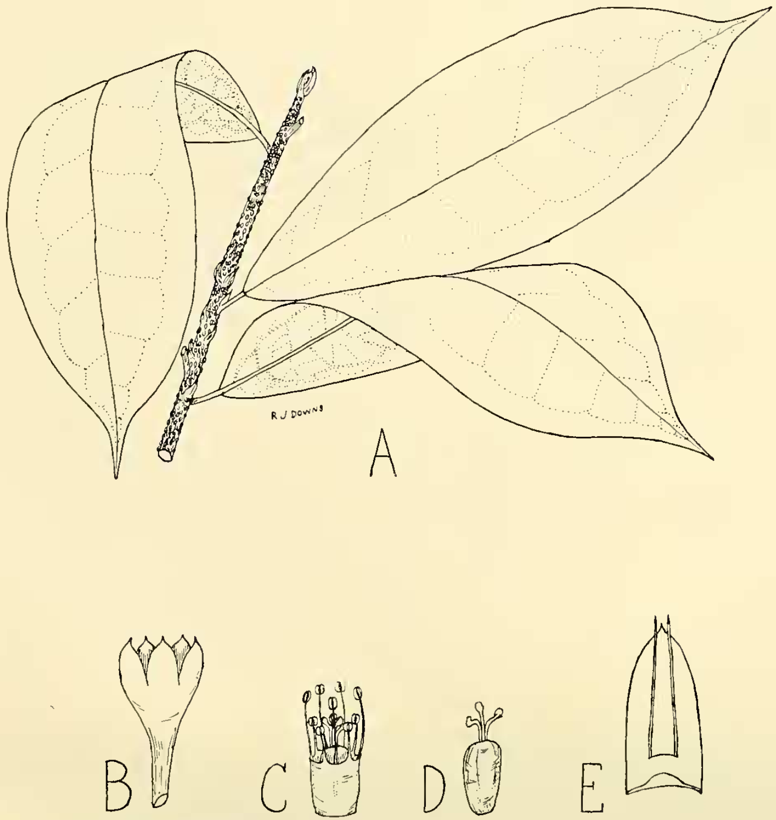

FIG. 3.—*Erythroxylon acrobeles:* A, Habit, × ½; B, calyx, × 5; C, stamens and ovary, × 5; D, ovary, × 5; E, stipule, × 5.

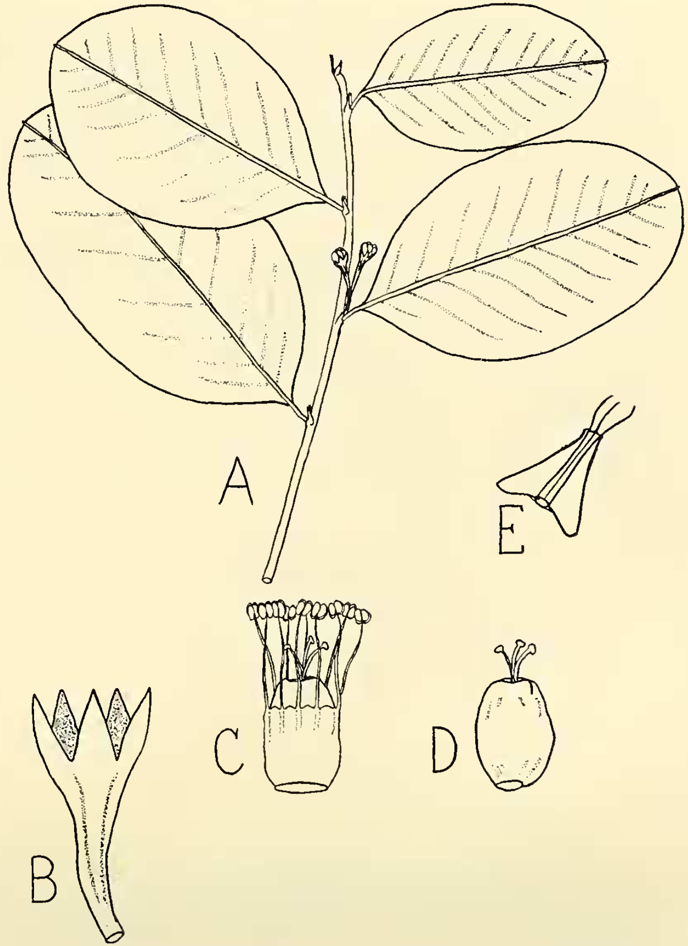

FIG. 4.—*Erythroxylon haughtii:* A, Habit, × 1; B, calyx, × 5; C, stamens and ovary, × 5; D, ovary, × 5; E, stipule, × 5.

partito, laciniis 1.5–2 mm longis, late lanceolatis; petalis 2.5–3 mm longis, laminis 2.5–3 mm longis, ligula laminam ad 3/4 aequante. Floribus brachystylis: urceolo stamineo calycem subaequante, orificio 10-crenulato; staminibus 2.5 mm longis, stylis liberis, 1 mm longis, stigmatibus depresso-capitatis, ovario ovoideo. Floribus dolichostylis: non visis. Drupa non visi.

CAUCA: Near Mercaderes, alt. 1100 m, October 27, 1946, Oscar Haught 5143.

This species differs from *E. orinocense* and *E. hondense* in having pedicels 7–11 mm long.

PROTECTIVE COATINGS FOR TITANIUM

The National Bureau of Standards has successfully electrodeposited hard, adherent protective coatings on titanium. The procedure involves forming a titanium fluoride film on the metal surface, electroplating with chromium, and heat-treating the plated specimen at 800°C. Developed for the Springfield Armory by C. L. Stanley and A. Brenner of the Bureau staff, the process is expected to extend considerably the utility of titanium metal, particularly for high-temperature applications.

Because of titanium's high strength-to-weight ratio, it ranks with steel and aluminum as a structural material. However titanium has disadvantages for some applications: it tends to gall or seize when in loaded contact with itself or other metals, and it oxidizes at elevated temperatures. These disadvantages could be minimized if titanium were coated with hard, oxidation-resistant metals such as chromium or nickel, but previous attempts to produce such coatings have not been entirely successful. Although the Bureau had obtained good adhesion of aluminum to titanium in an earlier investigation using a nonaqueous plating bath, the method was not suitable for job-shop applications and the results were not sufficiently consistent.

The main problem in depositing metals on titanium is lack of adhesion—some deposits have actually exfoliated during the plating operation and others have been easily pulled off with the fingers. Poor adhesion has been blamed on an oxide film on the base metal, but attempts to remove the suspected film with acid etches or anodic films were not successful. For this reason, the present investigation included a study of the influence of oxide films and methods to remove them.

In a preliminary investigation, the Bureau designed an experiment intended to remove any oxide film and to plate the titanium specimen before it could reoxidize. In this procedure, a small piece of titanium was enclosed in an evacuated tube containing silicon carbide and ceramic balls. The tube was tumbled for several hours to abrade the metal surface and then placed in a chromium plating bath, where it was crushed so as to expose the metal specimen to the bath before the atmosphere could touch it. In a control experiment, a titanium specimen was similarly abraded in an open tube. The adhesion of the first specimen was distinctly better than that of the control, supporting the hypothesis that a film, probably an oxide, exists on the surface of titanium and impairs adhesion of metal deposits.

The Bureau investigated a number of etching and plating procedures and obtained the best chromium plates by pretreating titanium to form a coating of titanium fluoride before plating the specimen. This procedure appears to prevent the formation of an oxide and, when the specimen is placed in the plating bath, the titanium fluoride dissolves permitting the chromium to bond directly to the basis metal.

Titanium specimens are thoroughly degreased and cleaned before this treatment. Next they are dried and suspended in a solution of hydrofluoric and acetic acids. After 10 or 15 minutes a 60-cycle alternating current is passed through the specimen for another 10 minutes. The specimens are then rinsed and transferred to a conventional chromium plating bath, where they are plated at a temperature of 85°C and a current density of 120 amp/dm^2.

Chemical analysis indicates that the film produced by the preliminary acid treatment contains a low valence titanium compound. A sample of the dried film contained 37 percent of titanium and 54 percent of fluorine,